CLAIMS

In this amendment, claims 13, 18 and 21 are amended. Claim 14 is canceled without prejudice. No new matters have been added.

1-12 (Canceled)

13. (Currently amended) A method for simulating structural responses of a rubber-like material in finite element analysis, the method comprising:

defining a plurality of finite elements ~~and~~ in a finite element model representing a structure that contains the rubber-like material;

obtaining a strain-stress curve of a specimen of the rubber-like material from a uni-axial test to represent the rubber-like material;

~~iteratively~~ calculating a plurality of stress function $f(\lambda_i)$ values at a plurality of corresponding stretch ratios λ_i of the rubber-like material and associated stress values σ (λ_i-1) defined in the strain-stress curve, wherein the calculating the plurality of stress function is performed without guessing material coefficients, in a trial-and-error manner, to fit the strain-stress curve obtained in the uni-axial test;

storing the plurality of stress function $f(\lambda_i)$ values into a stress function lookup table;

obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;

determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and

transforming the principal stresses into global coordinate system.

14. (Canceled)

15. (Previously presented) The method of claim 13, wherein the stretch ratio is a ratio between deformed length divided by original length of the rubber-like material in one direction.

16. (Previously presented) The method of claim 15, wherein the stretch ratio is equal to strain of the rubber-like material minus 1.

17. (Previously presented) The method of claim 13, wherein the strain has a range between -0.8 and 1.2.

18. (Previously presented) The method of claim 13, said iteratively calculating the plurality of stress function $f(\lambda_i)$ values further includes:

(a) calculating a function value by multiplying an initial stretch ratio λ with the associated stress value at $(\lambda-1)$;

(b) initializing an old stretch ratio λ_{old} with the initial stretch ratio λ;

(c) calculating a new stretch ratio λ_{new} as an inverse of square root of the old stretch ratio λ_{old};

(d) when absolute value of $(\lambda_{new}-1)$ is less than or equal to a predetermined threshold, assigning the function value to a particular one of the stress function values corresponding to the initial stretch ratio λ

(e) otherwise,

adjusting the function value by adding another term, wherein another term is calculated by multiplying the new stretch ratio λ_{new} with the associated stress value at $(\lambda_{new} -1)$;

assigning the new stretch ratio λ_{new} to the old stretch ratio λ_{old}; and repeating (c), (d) and (e), until (d) has been satisfied.

19. (Previously presented) The method of claim 18, wherein the predetermined threshold is 0.01.

20. (Previously presented) The method of claim 13, said determining principal stresses in principal directions from the stress function lookup table further includes

interpolating the stress function lookup table to obtain the principal stresses at the principal stretches.

21. (Currently amended) A computer program product including a computer usable medium having computer readable code embodied in the medium for causing an application module to execute on a computer for simulating structural responses of a rubber-like material, the computer program product comprising:

program code for defining a plurality of finite elements ~~and~~ in a finite element model representing a structure that contains the rubber-like material;

obtaining a strain-stress curve of a specimen of the rubber-like material in a uni-axial test to represent the rubber-like material;

program code for ~~iteratively~~ calculating a plurality of stress function $f(\lambda_i)$ values at a plurality of corresponding stretch ratios λ_i of the rubber-like material and associated stress values σ $(\lambda_i\text{-}1)$ defined in the strain-stress curve, wherein the calculating the plurality of stress function is performed without guessing material coefficients, in a trial-and-error manner, to fit the strain-stress curve obtained in the uni-axial test;

program code for storing the plurality of stress function $f(\lambda_i)$ values into a stress function lookup table;

program code for obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;

program code for determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and

program code for transforming the principal stresses into global coordinate system.

22. (Previously presented) The computer program product of claim 21, said program code for iteratively calculating the plurality of stress function $f(\lambda_i)$ values further includes:

(a) program code for calculating a function value by multiplying an initial stretch ratio λ with the associated stress value at (λ-1);

(b) program code for initializing an old stretch ratio λ_{old} with the initial stretch ratio λ;

(c) program code for calculating a new stretch ratio λ_{new} as an inverse of square root of the old stretch ratio λ_{old};

(d) when absolute value of (λ_{new}-1) is less than or equal to a predetermined threshold, program code for assigning the function value to a particular one of the stress function values corresponding to the initial stretch ratio λ

(e) otherwise,

program code for adjusting the function value by adding another term, wherein another term is calculated by multiplying the new stretch ratio λ_{new} with the associated stress value at (λ_{new} -1);

program code for assigning the new stretch ratio λ_{new} to the old stretch ratio λ_{old}; and program code for repeating (c), (d) and (e), until (d) has been satisfied.

23. (Previously presented) The computer program product of claim 21, said program code for determining principal stresses in principal directions from the stress function lookup table further includes program code for interpolating the stress function lookup table to obtain the principal stresses at the principal stretches.

24. (Currently amended) A system for simulating structural responses of a rubber-like material in finite element analysis, the system comprising:

an I/O interface;

a communication interface;

a secondary memory;

a main memory for storing computer readable code for an application module;

at least one processor coupled to the main memory, the secondary memory, the I/O interface, and the communication interface, said at least one

processor executing the computer readable code in the main memory to cause the application module to perform operations of:

defining a plurality of finite elements in a finite element model representing a structure that contains the rubber-like material;~~and~~

obtaining a strain-stress curve of a specimen of the rubber-like material in a uni-axial test to represent the rubber-like material;

~~iteratively~~ calculating a plurality of stress function $f(\lambda_i)$ values at a plurality of corresponding stretch ratios λ_i of the rubber-like material and associated stress values σ $(\lambda_i\text{-}1)$ defined in the strain-stress curve, wherein the calculating the plurality of stress function is performed without guessing material coefficients, in a trial-and-error manner, to fit the strain-stress curve obtained in the uni-axial test;

storing the plurality of stress function $f(\lambda_i)$ values into a stress function lookup table;

obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;

determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and

transforming the principal stresses into global coordinate system.

25. (Previously presented) The system of claim 24, said iteratively calculating the plurality of stress function $f(\lambda_i)$ values further includes operations of:

(a) calculating a function value by multiplying an initial stretch ratio λ with the associated stress value at $(\lambda\text{-}1)$;

(b) initializing an old stretch ratio λ_{old} with the initial stretch ratio λ;

(c) calculating a new stretch ratio λ_{new} as an inverse of square root of the old stretch ratio λ_{old};

(d) when absolute value of (λ_{new}-1) is less than or equal to a predetermined threshold, assigning the function value to a particular one of the stress function values corresponding to the initial stretch ratio λ

(e) otherwise,

adjusting the function value by adding another term, wherein another term is calculated by multiplying the new stretch ratio λ_{new} with the associated stress value at (λ_{new} -1);

assigning the new stretch ratio λ_{new} to the old stretch ratio λ_{old}; and repeating (c), (d) and (e), until (d) has been satisfied.

26. (Previously presented) The system of claim 24, said determining principal stresses in principal directions from the stress function lookup table further includes operations of interpolating the stress function lookup table to obtain the principal stresses at the principal stretches.